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The Botanical Laboratory at Oxford.

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In 1886 I published a short account of the botanic garden, library and herbarium of Oxford,[1] to which I must refer readers who wish to get some information about the history and the resources of this botanical institution. I will only repeat here that these resources are very extensive, as the laboratory is situated in a botanic garden which, though not very large, contains representatives of almost all natural orders, and is connected with a very large herbarium and a good library. In the present paper I wish only to offer a few remarks about the arrangements in the laboratory, which have all been made under the direction of Professor Isaac Bayley Balfour, though the different rooms composing it were built before his time.

Having entered the botanic garden through the magnificent old porch opposite the famous tower of Magdalen College, one sees on the right a rather large building with two wings attached to it. The central part of this building contains the lecture-room, the botanical museum and a chemical laboratory (the latter belonging to Magdalen College), while the wings form the botanical laboratory. If we enter the first wing we find ourselves in a room which in future will be fitted out as a physiological laboratory, the other wing being used for morphological studies. In the former we see,

[1] Botanisches Centralblatt Bd. xxv, No. 16.

first of all, a big cultivator, in which plants can be grown at constant temperatures. It further contains several bacteriological instruments, such as an incubator, a hot-air sterilizer and a steam sterilizer. Along the walls stand a number of cases in which thermometers, hygrometers, pipettes, burettes, bottles and flasks of different kinds, staining materials, imbedding materials, slides, cover slips, double-wall jars (which can be filled with colored fluids so as to grow plants with colored light), disks, glass boxes, etc., are kept in stock. In this room a great number of chemical reagents, glass tubes, etc., are also kept. There is a small room adjoining, which is the professor's private room, and in which all delicate instruments are kept when not in use, *e. g.*, an auxanometer, a galvanometer, a klinostat, a chemical balance, microscopes, microtomes, polariscope, microspectroscope, a magic-lantern, etc.; also, a large collection of slides for the magic-lantern and several other things. Leaving the first mentioned room by another door, we come to a staircase which leads into the museum. The latter contains a large collection of models and specimens (both in spirit and dry). Perhaps I shall describe the museum more in detail in a future article; at present I will only mention that it is chiefly to serve as a place where the materials necessary for showing in lectures are kept, not as a place for the instruction of the public. Having passed this staircase, we see on the left hand side a small room which can be completely darkened. It is used for photographic purposes, but of course it can also be made available for growing plants, either in complete darkness or with colored light. The laboratory possesses a very good microphotographic apparatus by Zeiss. We now pass into the lecture-room. On the walls we notice, among other things which are hardly worth mentioning, Noll's apparatus for demonstrating the secondary growths of woody stems. There is nothing else in the front part of the room which attracts our attention, except, perhaps, a plain lecture table and benches for the students; but in the back part we see a large stand with glass dishes, etc. This is the same stand which the late Mr. Thomas Walton exhibited in 1886 at the Birmingham meeting of the British Association for the Advancement of Science for growing algæ and other organisms in sea water or fresh water. It is very ingeniously constructed, but its arrangement can not be clearly explained without diagrams. Owing to circumstances which could not be foreseen, it has not yet worked very well here; but it is

expected that the present difficulties will soon be overcome. Opposite the stand there are a number of cases which contain a large collection of systematically arranged diagrams and drawings for use in lectures. Among them are the well-known diagrams by Kny and Dodel-Port.

Entering now the other wing of the building, we first come into a small coat-room, and then we reach the morphological laboratory. This is a spacious room provided with large windows which are almost as high as the room itself. There is very little space left between them, so that they afford very good light. Unfortunately, they look toward the south, which is a great drawback, as blinds have to be used when the sun shines. The students occupy tables which form a row along the windows. These tables are quite plain and strongly built. I do not think that it is necessary to have any specially constructed desk for morphological botanical work, either microscopical or macroscopical. Each table is provided with two gas lamps, as usually two students work at one table. On each of them there is a stand on which bottles containing reagents can be placed in such a way that they are protected from the direct sunlight. The bottles used for reagents are those known as glass-capped bottles. As each of them has its separate glass rod, the reagents are always kept pure. This is a rather important point, often too little valued by beginners. The following is a list of reagents which every student preparing for the preliminary examination[2] receives: glycerine, Schultze's solution, solution of iodine in water (with KI), sulphuric acid, hydrochloric acid, acetic acid, potash, aniline sulphate (dissolved in dilute sulphuric acid), solution of phloroglucin, Kleinenberg's Hæmatoxylin, solution of iodine in pure water (the latter when required). Of course, more advanced students get everything that is necessary in modern microscopic technique. It may be mentioned here that boiling of tissues with Schultze's macerating fluid is always done in the small room which leads into the morphological laboratory. Besides these reagents, every student receives a bottle of methylated spirit, a bottle of distilled water, several small dishes and glass boxes, some blotting-paper, a dissecting microscope, a compound microscope and a moist chamber (the latter when required). He has to provide himself with slides, cover-slips, a good hollow-ground razor, a few scalpels, a pair of scissors, a few needles, a few camel-hair brushes of different sizes, a

[2] An examination which every student of science or medicine has to pass before entering into special studies.

sketch-book and drawing implements. The practical teaching of the "preliminary men" is, on the whole, guided by "Bower and Vines' Practical Botany." A sufficient supply of material for these men is always kept in spirit, but fresh specimens are examined whenever this is required and the season is favorable. A collection of microscopical preparations illustrating Bower and Vines' book is kept in order to be shown whenever a student, after several attempts, fails to get a sufficiently good preparation himself. The middle part of the room is occupied by two large tables, which serve for various purposes at different times and are very useful. Along the rear wall there is a bench with several sinks for washing plants, bottles, etc., several warm chambers, imbedding apparatus, Bunsen burners, etc. Above these are several shelves on which a great many things frequently used are placed, such as jugs, dishes, bottles, a rough balance, a distilling apparatus, large bottles containing spirit, solutions of chromic acid and picric acid, common salt, distilled water, smaller bottles filled with potash, soda, several acids, alcohol of different strengths, Schultze's macerating fluid, etc. Along the other walls there are cupboards, in which a pretty large collection of systematically arranged materials for investigation, chiefly preserved in spirit, is kept. The material for the "preliminary men" is kept separate or arranged according to Bower and Vines' book. There are also a number of smaller cupboards, each with a separate key, in which the students keep their private property. In describing our laboratory I have endeavored to enumerate at the same time most things necessary for a botanical laboratory. In conclusion I may mention that anybody interested in the construction of a new laboratory will find much useful information in a book by E. C. Robins, entitled, "Technical School and College-Building." (London, 1887. Whittaker & Co.)

Oxford, England.

Zygomorphy and its causes. III.

CHARLES ROBERTSON.

When shallow gamopetalous flowers become horizontal, they are subject to the same conditions as polypetalous flowers, and, like them, are apt to become sternotribe.

The flower of Campanula Americana[22] looks outward and a little downward, and would be regular but for the curvature of the style. The genus is actinomorphic, but this species is in the first stage of zygomorphy. Bees light upon the flower in such a way that the ventral surface of the abdomen strikes the pollen-bearing style in the male stage and the open stigma in the female stage. The style is bent down, so that the epigynous nectary is only accessible on the upper side. The uppermost flower of the spike commonly blooms before many of those below it. This flower often stands nearly erect and its style is nearly straight, so that it has much the same insect relations as in a terminal regular flower.

Deep gamopetalous flowers with exserted stamens and styles are also visited by insects lighting on these organs. They become sternotribe, access to the tube being on the upper side. In Lonicera one lobe forms the lower lip, while there are four in the upper, illustrating the tendency of sternotribe flowers to develop the attraction above the landing.

When a deep gamopetalous flower with included stamens and styles becomes horizontal, the convenient landing is on the lower side of the tube. The insect crawls back under the stamens and styles, so that these organs strike it on the back. The flower is, therefore, nototribe from the start, and it becomes advantageous for the organs to bend to the upper side of the flower and turn the anthers and stigmas so that they will strike the insect more effectually.

The lower nectary is most convenient, since it is in front of the landing. When the stamens and styles turn to the upper side of the flower, they make the lower nectary more convenient and the upper more inaccessible. A single nectary may be retained on the lower side, or an originally central nectary may become more strongly developed or only accessible on the lower side.

That these conditions in the insect relations have led to the production of nototribe flowers is supported by the fact that such flowers belong to gamopetalous orders, Scrophulariaceæ, Labiatæ, etc.

But some flowers belonging to these orders are sternotribe, such as Scrophularia.

[22] For an account of the proterandry of this plant and figs. see Barnes, Bot. Gaz. X, 349, and pl. X, figs. 2 and 3. The flower is adapted to the larger bees, Apidæ. I have seen the following insects on the flowers: Hymenoptera—(a) *Apidæ:* (1) Bombus Virginicus Oliv. (mn); (2) B. separatus Cress. (m); (3) B. Pennsylvanicus De Geer (n); (4) Apathus elatus Fabr. (m); (5) Melissodes bimaculata St. Farg. (mn); (6) Megachile brevis Say (f); all sucking as described above; (b) *Andrenidæ:* (7) Halictus sp. (f); (8) Augochlora pura Say (f); both collecting pollen; (9) Prosopis affinis Sm. (f); eating pollen. The Andrenidæ behaved dysteleologically, only visiting flowers in the male stage. (c) *Sphecidæ:* (10) Ammophila sp., trying to find nectar. Lepidoptera—(a) *Nymphalidæ:* Pyrameis cardui L., trying to find nectar.

Under S. nodosa H. Müller[23] says: "In most Lamiales and Personales the anthers lie in two pairs, one behind the other, and touch an insect visitor on the dorsal surface; the stigma then, to insure cross-fertilization, must also touch the insect on the back, and the style can scarcely lie elsewhere than between the two pairs of stamens, along the upper part of the corolla. The superior stamen comes in the way, and accordingly disappears; it has no chance of reappearing permanently, for it is directly injurious, and is weeded out by natural selection." * * "In Scrophularia, on the other hand, the anthers come in contact with the ventral surface of the insect. The fifth stamen is thus useless but not injurious; whether it be present or absent is of no importance, and it is therefore beyond the influence of natural selection. Accordingly, the small black scale-like appendage on the upper wall of the corolla in Scrophularia, which represents the fifth stamen, shows not unfrequently more or less complete reversion to its primitive form." It seems to me to be more consistent with the affinities of Scrophularia to suppose that the fifth stamen was aborted under the same conditions as in other didynamous flowers, and that the organs formerly occupied the upper side of the corolla. This will relieve us of the embarrassment of explaining the abortion of the fifth stamen under the influence of natural selection in most Scrophulariaceæ and "beyond the influence of natural selection" in Scrophularia. The antheriferous condition of the filament need not give us any trouble, but may rather confirm the supposition, since it is a plain indication that the conditions which led to the abortion of this stamen no longer exist to keep it reduced. I believe that the flower was originally adapted to bees, which squeezed into the tube, and that it has become shallow in adaptation to wasps. Increase of shallowness has had the effect of exposing the stamens, so that insects could light upon them, and they have therefore turned to the lower side. If the flower was originally shallow, and was visited by insects lighting on the stamens, I see no reason why the upper stamen should have been left behind.

There are other examples of sternotribe flowers belonging to nototribe types, but the reduction of the upper stamen in all, or most of them, is an indication that the organs were once crowded in the upper part of a narrow tube. There is generally no tendency to abortion of the stamens in sterno-

[23] Fertilization of Flowers, 434.

tribe flowers, since, the flower being shallow, there is room for many stamens without crowding.

We have observed that sternotribe flowers may become nototribe by inverting, and now it appears that nototribe flowers may become sternotribe by becoming shallow, or by having their stamens and styles exserted. An observation of H. Müller on the flower of Odontites serotina shows how it might be advantageous for the stamens to turn to the lower side of the flower, and may help us to understand the case of Scrophularia. He says:[24] "The upper lip, as the figure shows, projects so slightly that the anthers in great part protrude beyond it and are unprotected. This is sometimes the case to such a degree that bees thrust their tongues into the flower above the stamens and thus suck honey and shake out the pollen without leading to fertilization."

By reduction in size and close crowding, associated with an exsertion of the stamens and styles, some labiate flowers have lost the insect relations which I think have modified them. Like Amorpha, they are fertilized by insects crawling over the inflorescence. In this way Lophanthus[25] seems to have lost much of its labiate character.

In the foregoing it is claimed that the original visitors must have lighted on some part of the flower, and that the character of the irregularity depended on whether the place of lighting was below or upon the sexual organs. But some irregular flowers are specially adapted to humming-birds and hawk-moths, which suck without lighting.

The fact that most zygomorphous flowers are bee-flowers indicates the importance of bees as the principal visitors. The importance of bees in producing the modifications is even greater than is at present indicated by the flowers; for I think there is reason to believe that most, if not all, of these flowers which are not adapted to bees were originally modified by them and have been usurped by other visitors.

Humming-birds and hawk-moths fly so rapidly and suck so easily that it is not hard to understand how they might take possession of bee-flowers which suit their fancy. Flowers adapted to them vary in position from erect to pendulous, and they can suck all of these with equal convenience and without lighting. If they visit regular horizontal flowers, they are not influenced by any place of landing and can suck one nectary as conveniently as another, so that there is no

[24] Fertilization of Flowers, 446.

[25] See Foerste on L. nepetoides, Am. Nat. XVIII, 928.

advantage in the organs turning to any particular side. But zygomorphous flowers adapted to these kinds of visitors follow the same rule as those adapted to bees, *i. e.*, those of shallow origin are sternotribe and those of deep origin are nototribe. Therefore, I believe that they were originally adapted to bees which lighted on some part of the flower.

Many flowers adapted to humming-birds and Sphingidæ have a well developed landing which they could have had no influence in producing. This is shown by the fact that this part is sometimes much reduced in flowers adapted to them, as in Salvia splendens,[26] a bird-flower which belongs to a melittophilous genus. That birds have no influence in producing zygomorphous flowers is indicated by Lonicera sempervirens, which is more regular than the species visited by bees. Flowers originally modified by Sphingidæ are regular, like Datura, Convolvulus, etc.

Many flowers adapted to bees show butterflies, Sphingidæ and humming-birds as intruders, and this is important, since it enables us to understand how bee-flowers might become modified to suit them.

Linaria is a good example of a melittophilous genus. The broad tube is suited to bees, and the palate, which seems to be intended to exclude butterflies and flies, is easily opened by bees. H. Müller found L. vulgaris[27] visited exclusively by bees (8 species). In Illinois I found it visited by 5 species of bees and 4 species of butterflies. L. alpina, according to Müller,[28] is adapted to humble-bees, but is visited by Lepidoptera also. In Florida I found L. Canadensis visited by bees, but much more frequently by butterflies. The spur is very slender, and the tube has become so contracted that bees can only insert their tongues, and butterflies can not suck without touching the anthers and stigma. The palate seems to have lost its function, for it is so weak that it entirely fails to exclude butterflies or even flies. I have seen three flies sucking and eating pollen—*Toxophora amphitea*[29] Walk., *Mesograpta marginata* Say and *Baccha Babista* Walk. The color and other characters of this flower are melittophilous. yet it is modified to suit butterflies, which have become the predominant visitors.

Delphinium is adapted to bees, as far as observed. But Müller saw D. Consolida visited by butterflies, Hesperia and

[26] See Trelease Am. Nat. XV, 265.

[27] Fertilization of Flowers, 432.

[28] Alpenblumen, 275.

[29] The flies mentioned in this paper were named by Dr. S. W. Williston.

Satyrus. I have seen D. tricorne visited by 6 species of bees and 7 species of butterflies. Here is a bee-flower in which the number of species of butterflies exceeds the number of bees. The spurs point upward more or less directly, so that, while bees have no difficulty in clinging to the flowers, butterflies, which prefer erect flowers, are put to considerable inconvenience, especially the Papilios, which generally suck with their wings in motion.

One cause of a change of visitors in flowers of shallow origin is probably the inversion of the flower. If the flower of Delphinium tricorne should become inverted, the bees, being thus deprived of their accustomed landing, could not suck the flowers so easily, while the butterflies could suck with more ease.

The views expressed above may be summed up in the following propositions:

1. When shallow flowers become horizontal, insects light on the stamens and styles and prefer the upper nectary.

2. The stamens and styles bend to the lower side, and the lower nectaries abort.

3. Zygomorphous flowers of shallow origin are sternotribe, and have a single nectary present, or a central nectary more strongly developed or more accessible, on the upper side.

4. Nototribe flowers of shallow origin are inverted.

5. When regular tubular flowers with included stamens and styles become horizontal, insects land on the lower border and prefer the lower nectary.

6. The stamens and styles bend to the upper side, and the upper nectaries abort.

7. Zygomorphous flowers of deep gamopetalous origin are nototribe and have a single nectary present, or a central nectary more strongly developed or only accessible, on the lower side.

8. Sternotribe flowers of deep gamopetalous origin have originally exserted stamens and styles (Lonicera), or have become shallow (Scrophularia).

9. Irregular flowers were modified with reference to a landing place,[30] and were modified through the influence of insects lighting upon them.

[30] (2) Die Honigbehälter sind auf derjenigen Seite der Blume entweder nur vorhanden oder doch stärker entwickelt, auf welcher sich die Aufliegestelle (!) für die Insekten befindet.

(3) Die Staubgefässe wenden ihre Beutel mit den Oeffnungseiten der Aufliegestelle (!) der Insekten zu; daher im ganzen auch den Honigbehältern. Jordan, Stellung der Honigbehälter und der Befruchtungswerkzeuge in den Blumen, 54.

10. Irregular flowers adapted to insects which do not light have changed visitors.

11. Small, closely-crowded flowers do not tend to become zygomorphous.

12. Small, closely-crowded, irregular flowers are liable to lose their zygomorphous characters, unless the stamens and styles are protected by galeæ, carinæ, etc.

Carlinville, Ill.

Proceedings of the Botanical Club.

WEDNESDAY, AUGUST 15, 1888.—The Botanical Club of the A. A. A. S. was called to order by the President, David F. Day, who spoke a few words of welcome and good cheer. Considering the time, the attendance was excellent. In the absence of the Secretary, Prof. V. M. Spalding, Rev. William M. Beauchamp was elected Secretary *pro tem.*

Mr. Thomas Meehan read a paper on the elasticity of the filaments in Compositæ. Mr. Meehan pointed out the elasticity of the filaments of a few Compositæ in 1883, and brought the matter before the Association in 1884, when some questions were raised whether it was not irritability rather than elasticity that caused the behavior.[1] He now adds that the filaments of a large number of Compositæ are elastic (Heliopsis exhibits it most clearly), and describes an observation upon Helianthus doronicoides which shows that it is not irritability.

Mr. W. H. Seaman followed with some remarks upon the variation of Azalea nudiflora in respect to odor and viscidity. This species, when growing in high latitudes and on mountains, is quite viscid and odorous, while in lower ground and more southerly stations it is smoother and nearly odorless.

Mrs. H. L. T. Walcott corroborated the observation in regard to the species about Medford, Mass.

Mr. Meehan read a second paper upon gyno-diœcious Labiatæ. He added to the already-known species Nepeta grandiflora, a native of the Caucasus, and pointed out the differences between the hermaphrodite and pistillate plants. In the former the heads of flowers are more numerous, but less fertile, the flowers are much larger and more loosely spicate and the internodes longer. Mr. Meehan thought the

[1] See this journal, vol. IX, p. 158.

less fertility of the hermaphrodites due to lessened opportunities for the pistils to obtain nutrition rather than to defective pollination. The cause of the tendency to abort the stamens in many Labiatæ he thought scarcely identical with that which causes gyno-diœcism. Mr. Meehan's papers will appear in full in the Proceedings of the Philadelphia Academy. After discussion, the club adjourned.

THURSDAY, 9 A. M.—The club was called to order by the President. About thirty present. W. H. Hale, chairman of the committee appointed, made a report adverse to the formation of a botanical section. The report was adopted.

A letter was read from Mr. J. D. Rockefeller inviting the club to visit his grounds, which, being largely natural, might be of interest. As it was impossible to spare the time, the club instructed the Secretary to express their thanks for the kind invitation and regrets that they were unable to accept it.

Mr. Meehan moved the appointment of a committee to draft resolutions on the death of Dr. Asa Gray. The chair appointed Messrs. Meehan, Barnes and Kellicott.

Mr. Beauchamp called the attention of the club to living specimens of Erythræa Centaurium which he had brought for the use of the members from the original station at Oswego, N. Y. He then read a paper upon the Onondaga (Indian) names for plants, in which he enumerated the names of the chief plants known to these Indians, and gave their signification.

Mr. Meehan spoke on the tendency to irregularity in the tubifloral Compositæ. In Silphium perfoliatum and many other Compositæ two of the five lobes of the corolla are approximated to form an "upper lip," and three to form a "lower lip." The gynœcium is also frequently involved in this irregularity, and instead of being straight bends against the lower lip even when to do so it has to oppose the action of gravitation.

Dr. E. L. Sturtevant exhibited a large series of water-color drawings to illustrate the variability of the fruit of wild and cultivated species of Capsicum, a genus which he thinks contains but a few species, instead of the many which have been described.

Mr. B. E. Fernow endeavored to answer the question, "What is a tree?" by proposing a definition for the term. After showing the looseness of present definitions and the need of greater precision in the use of the word, he defined trees as woody plants, the seed of which has the inherent

capacity of producing naturally within their native limits one main erect axis not divided near the ground, the primary axis continuing to grow for a number of years more vigorously than the lateral axes, and the lower branches dying off in time.

The definition was objected to, and a lively discussion ensued, participated in by several members of the club, which the last speaker summed up by saying that we should still have shrubby trees and arborescent shrubs.

FRIDAY, 9 A. M.—The club met in the hall of general sessions. Upon motion, the President appointed as a committee to nominate officers for the ensuing year Messrs. Scribner, Barnes and Meehan. The committee to draft resolutions upon the death of Dr. Asa Gray reported the following, which were adopted by a unanimous rising vote:

Resolved, That the Botanical Club of the American Association for the Advancement of Science sincerely regrets that, meeting as it does but once a year, it should be among the last of similar associations to place on record its sense of the great loss which the whole world of science suffers by the death of Prof. Asa Gray.

Resolved, That, though among the last to contribute to the wreath of sorrow with which science everywhere is crowning the memory of Dr. Gray, this body takes a mournful pride in remembering that he was one of its honored members, and that it was as a botanist he won such eminent renown. We feel that we have a right to be among the chief of mourners at his departure from the field of labor he loved so well, and in a special degree to unite in sympathy with the many thousands who miss him everywhere.

Resolved, That copies of these resolutions be forwarded to the family of our deceased friend, and given to the botanical and other scientific journals for publication.

THOMAS MEEHAN,
C. R. BARNES,
D. S. KELLICOTT.

A paper by Dr. Geo. Vasey upon the "Characteristic Vegetation of the North American Desert" was read by Mr. Tracy, and illustrated by a number of lantern views of plants exhibited by Dr. E. P. Howland. This paper will appear in full in the GAZETTE.

Mr. C. R. Barnes spoke on the acridity of Arisæma triphyllum. Following up a suggestion in a note by Stahl in the *Biologisches Centralblatt* (see this journal, p. 24), experiments were made to determine whether the acridity of the expressed juice of the corm could be removed by filtering out the raphides. After one filtration the acridity was almost lost, while upon a second filtration the juice was entirely bland. It would seem likely, therefore, that the intense burning sensation was due to the penetration of the

mucous membrane of the mouth by the raphides, though this has not yet been crucially tested.

Mr. Lazenby mentioned the fact that the corm of Calla was less acrid than the petioles, and that it contained smaller quantities of crystals.

Mr. A. A. Crozier sent a paper on the secondary effects of cross-fertilization, which was read by Mr. Cowell. He had crossed many varieties of apples and other fruits to determine whether any effect appeared in the fruit of the first year, but his experiments led to the belief that it did not.

Mr. Cowell dissented from this view as contrary to his experience.

Mrs. Henrietta L. T. Walcott described and exhibited specimens of an amber-fruited choke-cherry, collected in Dedham, Mass. The chief differences are in the somewhat broader leaves, three or four times shorter and more compact racemes, and the amber-colored fruit. Dr. Sereno Watson proposes for it the varietal name *leucocarpa*.

Mr. W. R. Lazenby exhibited the two forms of Ampelopsis, one of which adheres to brick or stone walls, trees, etc., by means of the disk-like expansion on the tendrils, and the other of which will *not* climb walls and forms no disks. The latter is the only one sold by nurserymen, and much disappointment ensues from its failure to clamber over walls.

Mr. Beauchamp disagreed with Mr. Lazenby, and thought the tendrils were modified to suit circumstances.

Dr. Campbell suggested that the nursery plants were A. hederacea of Europe, and not A. Virginiana.

On Friday afternoon at 2 o'clock about forty members of the club boarded a special Brooklyn-line car, and, after a pleasant ride across the city, alighted at Brighton, where a few minutes' walk took them into a wild glen, with numerous side ravines cutting into it. The region was not specially remarkable botanically, but served to give a fair idea of the August flora of the country. Jeffersonia diphylla was collected in fruit, and proved to be a rarity to eastern botanists. The mycologists gathered the richest collection, but all brought in some plants of interest. At 5:30 the car was found awaiting the party, and an hour's ride brought them again to their lodgings. These short excursions are among the pleasantest features of the Association, and serve to promote the friendly intercourse which is perhaps as important and beneficial as the information gained. The club feel

under special obligations to the local botanists who perfected the arrangements and did so much to make the trip pleasant.

MONDAY, 9 A. M.—The club was called to order by Dr. W. J. Beal, in the absence of the President.

Mr. Joseph F. James exhibited a series of forms of Dentaria laciniata and D. multifida, and held that the latter should be considered as a variety of the former. He also showed an abnormal form of Asclepias tuberosa with flexuous stem and sub-opposite leaves, which he thought entitled to the varietal name, *flexuosa*.

Mr. F. L. Scribner gave some observations on nomenclature. He read an extract from a letter of Dr. Hackel (see page 243) on the citation of authorities. He stated the objects of citation to be two, viz., to fix the species meant and to furnish a clew to the literature. The following case was cited: Pursh described Stipa membranacea; Thurber, ignorant (as almost every one was) of Pursh's name, called it Eriocoma cuspidata; it turns out to be an Oryzopsis; ought Scribner to go back to Pursh's specific name, *membranacea*, or is he right in calling it *Oryzopsis cuspidata* Scrib.?

The general topic awakened discussion. Mr. Barnes contended for the indivisibility of a plant name and the citation in lists, etc., of a single author after it, without any intention of "giving credit."

Mr. James and Mr. Beauchamp thought the author of the specific name ought to be cited in parenthesis, a proceeding the uselessness of which either for reference or "credit" was pointed out by Mr. Scribner.

Mr. F. L. Scribner also read a paper on Sphærella Fragariæ, the strawberry leaf-blight. As a justification for the formation of the common name, he stated the principle adopted by the section of vegetable pathology. The diseases or injuries caused by Ramularia, Cercospora, etc., are called "blight;" those caused by Uredineæ are "rust;" those due to Phyllosticta, Septoria, etc., are "leaf-spot." The author enumerated and remarked on the fungi thought to represent the stylosporic form of Sphærella. He has found the spermagonial stage, he believes, which is quite distinct from Septoria aciculosa. We therefore know all three stages of the Sphærella.

Mr. Meehan spoke on the functions of the peduncular bract of Tilia. He thinks it is, among other things, for the purpose of holding up the peduncle so the flowers will not hang too close together, and also to bring them under the leaves so that bees can work at them in wet weather.

Mr. D. H. Campbell spoke of the germination of Marsilia Ægyptiaca. Of spores from herbarium specimens eleven years old, fifty per cent. germinated, and of those five years old, almost all grew. From 10–12 hours suffices for the germination and complete formation of male and female prothallium.

The committee for nominating officers for the ensuing year reported, naming for President, T. J. Burrill, of Champaign, Ill.; for Secretary and Treasurer, D. H. Campbell, of Detroit. They also recommended the establishment of the office of Vice-President, and nominated B. D. Halsted, of Ames, Iowa. The report was adopted and the officers elected.

Dr. Vasey sent to the club a report of progress of the Botanical Exchange Club. (See p. 240.)

TUESDAY, 9 A. M.—W. R. Lazenby spoke of the flora of Ohio, referring chiefly to that of Franklin county, which showed 714 Phanerogams, and not a single Ericad.

F. L. Scribner made some remarks concerning Andropogoneæ, referring to Hackel's forthcoming work. [This paper will be published later in the GAZETTE, together with citations of herbarium numbers, so as to make it immediately available to American botanists.—EDS.]

Changes in host plants, induced by Puccinia graminis, were discussed in a paper sent by V. M. Spalding. The leaf where affected is three times as thick as elsewhere. In wheat the epidermal cells are often enlarged and ruptured. Contents of cells show chlorophyll bodies decomposed. He referred also to the changes in the grain.

M. B. Waite spoke of changes in the fungus flora near Champaign, Ill.

W. J. Beal gave an account of the flowering plants of Northern Michigan.

Abstracts of the botanical papers read before section F of the A. A. A. S., at the 37th meeting, Cleveland, Aug. 15–22, 1888.

A plea for uniformity in biological nomenclature: by N. L. BRITTON.

The paper cites the discrepancies in the application of the law of priority in the binomial and trinomial citation of organisms and urges a method to secure uniformity.

[Dr. Britton is absent in England, and his paper did not reach the section. As only the above extract was read, there was no discussion.]

A study of Hydrangea as to the objects of cross-fertilization: by THOS. MEEHAN.

The author detailed a number of facts connected with the structure and development of allied species of Hydrangea, and argued that on no theory of evolution based on adaptation to insect visits could these changes occur. He contended that variety must exist in order to provide for order, and that variations, as we see in Hydrangea, can be of no special benefit to the plant, but exist for mere variety's sake.

A phase of evolution: by E. LEWIS STURTEVANT.

Botanical varieties are the unit of evolutionary progress under vegetable culture, as evidenced by a study of cultivated and wild dandelion. Colored drawings and herbarium specimens were exhibited demonstrating the substantial identity of garden varieties with wild varieties, and, conversely, showing the types for new future varieties.

[Discussed by Messrs. Campbell, Tracy, Riley, Lazenby and Meehan.]

Notes on the inflorescence of Callitriche: by JOS. SCHRENK.

The bracts of the inflorescence, which Caspary calls stipules and Schenk calls trichomes, the author finds to be bladders filled with air and with walls of a single layer of cells. The cavity of these organs is schizogenous and they are equivalent to phyllomes. Their purpose is to give necessary buoyancy to the apex of the stem. A study of the histology of the flower-cluster makes the author believe that the stamen and pistil constitute one flower, so that it is not monœcious, as described, but perfect.

[In the absence of the author, the paper was read by the Secretary. No discussion.]

Hygroscopic movements in the cone-scales of Abietineæ: by ALBERT N. PRENTISS.

In most of the Abietineæ, soon after the maturation of the cones, the persistent scales fold backward or outward from the axis to permit the ripened seeds to escape. The scales are very sensitive to moisture, and in many species exhibit very rapid movements when wet, as with rain. This is especially well seen in the cones of Tsuga Canadensis, in which the widely-open scales become completely closed in twelve minutes. This property of the cone-scale is found to be very efficient, first, in loosening the winged seeds from the scale which bears them, and second, in favoring the wide

dispersion of the seeds, as the cones open and close many times before all the seeds are sown, thus securing their transport in different directions by the varying winds.

[The above abstract was read by the Secretary. No discussion.]

Some new facts in the life-history of Yucca and the Yucca moth: by THOS. MEEHAN.

The author gave some figures in regard to the time of opening and the duration of the flowers, with notes on the time and duration of the moisture exudation from the perianth. The cause of the sudden stoppage of the waste was discussed, and some remarkable facts in connection with Pronuba yuccasella, observed by Dr. Riley, confirmed. The remarkable adaptation by which an insect is made to do the work of self-fertilization which the plant could just as well do for itself was contrasted with similar observations in the animal kingdom.

[At the suggestion of Mr. Barnes, the President of the section, Dr. Riley, replied to the paper. He restated the facts, which had been demonstrated conclusively, that Yucca was incapable of self-fertilization, and that Pronuba cross-fertilizes the flowers and oviposits in the pod. He cited Trelease's observations on the nectary, showing that the moth gets no reward in nectar for this work. He characterized Mr. Meehan's conclusions as totally unjustifiable. Mr. Day remarked that his plants of Yucca were self-sterile, and he had no hesitation in saying that they were functionally diœcious.]

On the cause and significance of dichogamy in flowers: by THOS. MEEHAN.

The author repeated the announcement of his discovery, made first through the *Proc. Phil. Acad.*, that it takes a longer-continued amount of heat to excite growth in the female than in the male organs of flowers, and that varying seasons will therefore advance or retard the several sexual organs accordingly. Therefore, there is absolutely nothing in connection with the visits of insects to account for dichogamy, which is solely an accident of climatic environment.

[In the discussion which followed, Messrs. Day, Fernow and Barnes wholly dissented from the conclusions reached by the author.]

Adaptation in the honeysuckle and insect visitors: by THOS. MEEHAN.

The author gave all the points in the flowers of certain

honeysuckles, and the development of the extraordinary amount of nectar from which the plant derives its common name, and showed that the insects which visit the flower for the sweet secretions take no part in the pollination of the flower. This office is performed by pollen-gathering insects for which no special adaptation has been made, and which rather aid self- than cross-fertilization.

[Discussed by Messrs. Tracy, Day, Lazenby, Campbell, Burrill, Barnes, Sturtevant and Riley, most of whom disagreed with the deductions of the author.]

Systematic position of the Rhizocarpeæ: by DOUGLAS H. CAMPBELL.

The paper gave an account of the author's studies in the embryology of Pillularia and allied forms, which show the Rhizocarpeæ to be more nearly related to true ferns than heretofore supposed. The more intimate researches were carried on by means of paraffin imbedding and serial sections. The older literature was cited, and much shown to be erroneous on account of unsuitable methods.

[The work was commended by Messrs. Barnes and Burrill.]

Pollen germination and pollen measurement: by BYRON D. HALSTED.

I. The author, in studying the germination, sought to improve upon the methods, and after considerable trial adopted for holding culture liquid the artists' well-slabs, containing as large a number of wells as possible of such size that they can be covered with thin glass. The advantages are obvious in the comparison of various sorts of pollen under the same conditions or of the same sort in various solutions.

II. The second part of the paper gave measurements of various pollens, both moist and dry.

[No discussion.]

Comparison of the Flora of eastern and western Michigan in the latitude of 44° 40′: by W. J. BEAL.

The paper describes the climate and topography of the lake shores in the locality named. The following northern plants were found on the east side of the state, and not on the west side:

Ribes lacustre Poir.
Kalmia angustifolia L.
Kalmia glauca Ait.
Dracocephalum parviflorum Nutt.
Picea alba Link.
Sparganium simplex Hudson.
Carex Backii Boott.
Carex sterilis Willd.
Carex capillaris L.
Carex Houghtonii Torr.
Botrychium Lunaria Swartz.
Botrychium simplex Hitchcock.

The following southern plants were found on the west side and not on the east:

Acer dasycarpum Ehrh.
Rubus occidentalis L.
Sambucus Canadensis L.
Sassafras officinale Nees.
Ulmus fulva Michx.
Ulmus racemosa Thomas.
Adiantum pedatum L.

These lists, so far as they go, support the prevailing belief that the west side of the state has the milder climate, a view based upon the fact that tender fruits thrive better on the west than on the east.

[No discussion.]

Observations on the succession of forests in northern Michigan: by W. J. BEAL.

After referring to various unsatisfactory and unscientific theories as to the cause of the change in the character of a forest when a "second growth" appears after clearing or burning of the virgin forest, the author gives an account of his observations in various localities in Michigan. In a virgin forest there are, in addition to the Coniferæ, scattering trees of maples, oaks, ash, aspen and various shrubs and deep-rooted perennial herbs. The young deciduous trees are small and spindling, and almost always come from clustered roots called "grubs," showing that the present growth is not the original sprout, but the second, third or fourth from the same root. Often smaller plants, only a few inches high and less than an eighth of an inch in diameter, are found, which show by the bud-scale scars that they are four to ten years old. It is not difficult to find oaks under eighteen inches high that are twenty or more years old, and, as the present may be the third or fourth sprout, it is not improbable that the root is sixty to one hundred years old. All the deciduous trees named show the same mode of growth, while the young hemlocks and pines do not behave so. On examining "stump lands" which had just been burned over, abundant shoots of the deciduous trees named were found coming up from the stumps or roots, but no pines or hemlocks. Older stump lands show the same facts, the young deciduous trees, however, being larger.

On "jack-pine plains," where the second growth is still predominantly the jack-pine, seventy-two species of plants are quite uniformly observed, of which sixty-eight are perennials, including among trees two aspens, three oaks and one pine, with occasionally two other pines. Of the trees, the oaks survive fires in the way above indicated, the aspen

seeds are easily blown in by the wind, and seeds of the occasional pines come from neighboring territory. Pinus Banksiana, however, is specially adapted to seed itself in the same place by the persistent closure of the cones, which are borne even by very young (five-year old) trees. Only unusually dry weather, the death of the tree or the heat from a fire will cause the scales to open and allow the seeds to escape. Of seeds 2–4 years old, 95 per cent. germinated; from 4–6 years old, 85 per cent.

Thus, when the second growth is different from the first, it is explained by the persistence of the deciduous trees already present or the introduction of new species in the ordinary course of seed-distribution. When it is not different it is because the species of pine is specially adapted to reëstablishing itself.

[After a few questions, further discussion of the paper was postponed until Monday morning, when Mr. Fernow wished to speak upon it. He was called away suddenly, however, and the discussion was not resumed.]

Discovery of the production of immunity from contagious diseases produced by chemical substances formed during bacterial multiplication: by D. E. SALMON.

The author discussed and answered objections to this theory of immunity, which was presented to the Association in 1886. MM. Duclaux, Roux and Chamberland endeavor to minimize his discovery and claim priority, though their work is more recent. The early experiments were defended and their demonstrative character shown. The author, therefore, continues to claim priority.

[No discussion.]

BRIEFER ARTICLES.

The Botanical Exchange Club.—As there is no regular committee to report on the Exchange Club, and as that club owes an account of itself to its parent, the Botanical Club of the A. A. A. S., the following informal report has been prepared:

At one of the sessions of the club held during the New York meeting of the A. A. A. S., the Rev. Thomas Morong suggested that a botanical exchange club, similiar to those existing in Europe, be formed in this country. The suggestion met with the hearty approval of many members of the club. A committee, consisting of Dr. George Vasey, Dr. Sereno Watson, Dr. N. L. Britton, Rev. Thomas Morong and Prof. Byron D. Halsted, was appointed with power to act for the club, and to report

through the botanical magazines. The committee published, first in the GAZETTE, and in the *Bulletin* for February of this year, a preliminary outline for the organization of the Exchange, based on the rules of the Botanical Exchange Club of the British Isles, and asked for suggestions and improvements for a permanent constitution. A few months later the committee published a note announcing the location of the head-quarters of the Exchange at the National Herbarium, in the Department of Agriculture at Washington, and soon after the final report of the committee came out in the June number of the botanical magazines in the form of the governing rules of the Exchange.

As at present constituted, then, the Botanical Exchange Club consists of a number of persons organized for the purpose of exchanging botanical specimens, and governed by certain rules. The correspondence, finances and general management of the Exchange are in the hands of a director. A considerable number have already become members, and packages of specimens are beginning to come in. With the increased membership and contributions that the Exchange will have by the end of this season's botanizing, the director can soon put the exchanging into full active operation.

Printed copies of the rules will be distributed, and an opportunity will be given to any of the botanists present to become members of the Exchange. The annual fee of two dollars has been set for the purpose of paying the expenses of printing, transportation of specimens and correspondence.

All packages and correspondence should be addressed to Dr. George Vasey, Director of the Botanical Exchange Club, Department of Agriculture, Washington, D. C.

A list of new mosses of N. Am.—The descriptions and drawings of the following mosses, by F. Renauld and J. Cardot, will be issued shortly in the BOTANICAL GAZETTE:

Microbryum Flerkeanum Sch. var. *Henrici.*—Kansas (Henry).

Weisia viridula Brid. var. *nitida.*—Louisiana (Langlois).

Dicranum hyperboreum C. Müll. var. *papillosum.*—Greenland.

Dicranum sabuletorum (*D. spurium* var. *condensatum* Lesq. et James, non *D. condensatum* Hedw.). Southern States.

Dicranum scoparium Hedw. var. *sulcatum.*—Miquelon (Delamare).

Dicranum Howellii.—Oregon (Howell).

Dicranum Miquelonense.—Miquelon (Delamare).

Fissidens incurvus Schw. var. *brevifolius.*—Louisiana (Langlois).

Trichodon (?) flexifolius.—Florida (Sawyer).

Physcomitrium pyriforme Brid. var. *Langloisii.*—Louisiana (Langlois). New Jersey (Green).

Bryum Sawyeri.—Florida (Sawyer).

Fontinalis Oregonensis (sub-species of *F. antipyretica*). Oregon (Howell).

Alsia Californica Sull. var. *flagellifera*.—California (Miss Mann).

Eurhynchium strigosum B. S. var. *Barnesii*.—Idaho (Leiberg).

Plagiothecium denticulatum B. S. var. *microcarpum*.—Idaho (Leiberg).

Amblystegium riparium B. S. var. *serratum*.—Kansas (Henry).

Amblystegium riparium var. *Floridanum*.—Florida (Garber). Louisiana (Langlois).

Hypnum symmetricum (sub-species of *H. uncinatum*).—Idaho (Leiberg). Oregon (Howell).

Hypnum arcuatum Lindb. var. *Americanum*.—Louisiana (Langlois).

Silk seeking pollen.—Director Speer, of the Iowa experiment station, is making some interesting experiments on the fertilization of corn. It is found that the silk will remain green and in a receptive condition and grow in length for a long time if not fertilized. Some silks just measured which have been out nineteen days, but covered to prevent fertilization, are sixteen inches beyond the ear. In one instance a few silks were fertilized the second day after they appeared, and six days later the remainder, two sizes of kernels appearing on the ear. In another case the ear was covered until the silk was well started and then pollenized. Twelve days later it was examined and found to have set almost perfectly, but the kernels toward the base of the ear were the smallest, showing that the longest silks required the most time for fertilization. In ordinary cases the silks from the base of the ear appear much the soonest and the lower kernels become fertilized first. In another case where the outer (lower) silks were cut off and the whole left exposed a greater difference in size between the top and butt kernels appeared. Silks were repeatedly cut off and the ear afterward successfully fertilized, proving that it is not the forked apex of the silk alone that is receptive. A. A. CROZIER, *Ames, Iowa.*

EDITORIAL.

ANOTHER PROPOSITION was made and considered this year to erect the Botanical Club of the A. A. A. S. into a section, or at least a sub-section. Fortunately, we think, the committee reported adversely to the proposition, after consulting the council and those who have had some experience with similar movements in other sections. We hope that this endeavor will not be renewed. It tends, even when unsuccessful, to exaggerate the importance of the club, and to that extent to interfere with its usefulness.

ANOTHER PROPOSAL which we think would be equally harmful should it be acceded to was that the club request the council to publish its proceedings in the regular volume. The Botanical Club should hardly be formal enough to be said to have "proceedings." It is to be the place

where the short and less important observations can be set before our fellows; where the progress of investigations can be stated and coöperation asked; where movements for the benefit of botanists (such as the Exchange Club) can be initiated; where the botanists can meet informally and become better acquainted. Such were the objects of its founders, and these features it should be our endeavor to preserve. Any attempt to dignify it by adding formalities or limiting its freedom of speech would only ruin it.

AS IT IS, there is a growing tendency to encroach upon the biological section. The sectional committee this year followed the precedent of the past two years, and arranged the programme so that all the botanical papers were read in the morning, and all the zoological in the afternoon. This year the "cutting" of zoological papers by the botanists was more marked than ever. Hardly a corporal's guard was present in the afternoon. The zoologists, who largely attended in the morning, complained of the desertion, and with justice. We are quite convinced—the conviction has been growing for two years—that the programme should be once more arranged so as to intersperse the papers. Not that botanists should be made to listen to what they don't want to hear, but they should not be invited to desert the section, for they are likely to hear a zoological paper which will be quite as instructive and suggestive as a botanical one.

WE ARE quite unable to account for the fact that in general the Botanical Club was better attended this year than the biological section. The zoölogists were in the minority, both in number of members and number of papers. Very little can be claimed, however, for the quality of the botanical papers. With some exceptions, they showed a narrowness of observation and a superficiality of study which were lamentable. If we may assume the hortative, do let us broaden our conceptions of investigation, and when a subject is undertaken, look it from all sides, study its literature, and bring our observations and experiments to bear upon it in such a way that we reach not *a* conclusion, but *the* conclusion, and the *only* conclusion. If we do not narrow it to *that* point we lose all, and have merely our trouble for our pains.

OPEN LETTERS.

Prof. E. Hackel, on the citation of authors.[1]

If Mr. Bentham proposes the reduction of a genus to a section of another without giving a complete list of the changes in nomenclature which results from that alteration, *he is not considered* the author of any combination of names which is made by other persons adopting the reductions. For instance, Triodia acuminata, ambigua, mutica, stricta, Texana, etc., are no names of Bentham's, because you can never quote a page of his works where these names are to be found.

[1] Extract from a letter addressed to Dr. George Vasey, October, 1883.

On the other hand, are you sure that Mr. Bentham, if examining all the species named above, would maintain them all with the rank of species? Possibly, yes; but you can assert nothing, and therefore you can not attribute such names as Triodia Texana to him. * * *

As matters now are we must quote *Triodia Texana* Vasey in "The Grasses," etc., etc. The botanist who seeks this name in your book finds the indication "*Tricuspis Texana* Thurb.," and now he is at a loss where to find more information about that species. The author of Triodia mutica is F. L. Scrib. in Bull. Torr. Bot. Club X, p. 30. He is also the author of Hilaria rigida (in Bull. Torr. Bot. Club IX, p. 86), not Bentham, who, in Notes on Gram., p. 62, mentions only H. cenchroides, H. Jamesii, H. mutica, H. sericea, as congeners.

I is true that it is no merit to change a name if another has given the reasons for changing it, but the quotation of any name of author behind a combination of names *expresses or proposes no acknowledgment of merit* at all, but serves only to guide the botanist in his search for information about the species. This is the principle recognized by most European botanists, and it implies the other principle that the quotation of the book where to find information is more important than that of the author of the name.

Concerning nomenclature.

I was much surprised when I read in the BOTANICAL GAZETTE (June, 1888, p. 161): "Shall the law of priority apply only to the combined generic and specific name, or to the specific appellation as well?"

If I understand it means a doubt as regards the fixity of a specific name when a species is transferred to another genus.

This point has been clearly considered and settled in the 57th article of our *Laws of Nomenclature*, recommended by the Botanical Congress held at Paris in August, 1867[1]:

"When a species is moved into another genus the specific name is maintained, unless there arises one of the obstacles mentioned in the articles 62 and 63." (If the name exists already in the genus or could lead to some misconception.)

This rule is in conformity with the general principle not to change names without absolute necessity. It has also an advantage, which is to help remembering a species formerly in another genus.

We follow that rule in several cases more or less analogous to our scientific nomenclature. When Mexican cities have been transferred to the United States their names were not changed; when the name of a city is changed, those of the streets are kept; and if *John* Brown discovers that his real family name is Smith, he would be *John* Smith.

Allow me to recall that our *rules* were first submitted to a committee of eminent botanists of five different nationalities, afterward discussed in three sittings by more than a hundred members, and finally adopted by universal consent. Since that time I never heard any objection to the fixity of specific names, and if new names are given that are not necessary I would consider them as null.

Geneva, Switzerland. ALPH. DE CANDOLLE.

Polygamous flowers in the watermelon.

One of the characters given for Cucurbitaceæ is "flowers monœcious or dicœcious." In making some crosses to-day on the Volga watermelon,

[1]Translated in English. Reeves & Co., London. 1868.

a variety from southern Russia, I discovered that the so-called pistillate flowers possessed stamens. One hundred flowers were examined, and there were stamens in all. In seventy-six cases the stamens were three, the same as in the staminate flowers, which were present in about the usual number. In the others the stamens ranged from one to five. Where five were present they alternated with the five petals, and with the five parts of the pistil in such cases. Of the three stamens usually found, one stood alternate with the petals and the other two opposite to them, each of the latter showing by its position and larger size that it represented two.

A. A. CROZIER.

Ames, Iowa.

CURRENT LITERATURE.

A host-index of fungi.

Those who are acquainted with the Cryptogamic herbarium of Harvard University know what voluminous indexes are kept up to facilitate study of that splendid collection. In publishing an index to the hosts of parasitic fungi[1] the director and curator of the herbarium have placed at the disposal of students of fungi a most important help, one which will not only prevent the duplication of much drudgery, but will also greatly facilitate a more *accurate* study of the mycologic flora, and, therefore, "tend to lessen the amount of indiscriminate species-making, which has already become a serious evil." The index consists of a list of host plants arranged in the usual order, and in nomenclature following generally Watson's index. These names are printed in bold-face type, and followed by the names of fungi occurring upon them. Synonyms are but sparingly given, usually only those which have appeared in connection with the record of the occurrence of the species on particular hosts in N. A.

It is needless to dwell upon the utility of this publication. It commends itself at first thought to mycologists. The typography and arrangement are excellent. The authors expect to complete the work during the coming winter. Copies can be obtained for $1, by addressing either of the authors, at Cambridge, Mass.

The plant cell.

It is a little over twenty years since Hofmeister's "Lehre von der Pflanzenzelle" appeared, and in those twenty years a vast advance has been made in our knowledge of the finer structure of the plant cell by means of the improved optical appliances, and particularly the methods of investigation. As no work has appeared since the classical treatise of Hofmeister which gives in compact form a statement of the knowledge we possess about the plant cell, this book[2] of Dr. Zimmermann is specially

[1] FARLOW, W. G. and SEYMOUR, A. B.—A provisional host index of the fungi of the U. S.—Part I—Polypetalæ, pp. 52, sq. roy. 8vo. Cambridge: [the authors] August, 1888.

[2] ZIMMERMANN, A.—Die Morphologie und Physiologie der Pflanzenzelle. (Sep.-Abdr. aus der Encyklopädie der Naturwissenschaften: Abtheilung, Handbuch d. Botanik.) pp. 223, figg. 36, roy. 8vo. Breslau: Edward Trewendt. 1887.

welcome. It forms a part of Schenk's Hand-book of Botany, parts of which have already been noticed in this journal (vol. x. 314 and 331). So vast has become the literature of this subject that it has been quite impossible for Dr. Zimmermann to test all the observations recorded, but he has evidently used great care in quoting results, and has gathered from many sources. In a bibliography, "which lays no claim to completeness," 376 separate papers and works are cited. Botanists would thank the author had he done nothing more than summarize the chief points contained in these widely scattered papers; how much more do they owe him for the painstaking sifting and digesting which he has performed. The judicial remarks upon various opinions and theories seem to indicate a wise conservatism and the application of sound common sense to the intricate problems presented by the plant cell.

It is quite impossible to review this excellent work in detail in the space at command. We can serve our readers better by giving an insight into the scope of the work by citing the chapter headings. The first part (166 pages) treats of the morphology of the cell under the following main topics: Form of the plasma; intimate structure and chemical composition of the cytoplasm; the nucleus, its intimate structure and the chemical composition of the resting nucleus, nuclear division and coalescence; the chromatophores, their finer structure, chemical composition, inclusions, multiplication and metamorphoses; other organs of the plasma (such as cilia, eye-spots, etc.); proteid grains and crystalloids; starch grains and similar bodies; the solid and liquid inclusions of the cell; chemical composition, form, finer structure, origin and growth of the cell-membrane; cell-formation and growth.

The second part (40 pp.) treats the physiology of the cell under the heads: theory of swelling and osmose; physical properties of the cell-membrane; the hygroscopic parts of plants; physical properties of the plasma; aggregation; and the mechanics of the cell.

We venture to predict that this work will become as indispensable to students as Hofmeister's has been. American botanists especially will appreciate it the more because of the inaccessibility of most of the literature.

Minor Notices.

THE SEVENTH PART of Husnot's Muscologia Gallica[3] has been issued. It concludes the genus Orthotrichum, to which a key to species is given, and treats the genera Encalypta, Schistostega, Œdipodium, Dissodon, Tayloria, Tetraplodon, Splachnum. Ephemerum, Physcomitrella, Discelium, Pyramidula, Physcomitrium, Entosthodon, Funaria, Mielichhoferia, Orthodontium, Leptobryum, Anomobryum and Plagiobryum. Bryologists will notice the new association of the genera. The plates of this valuable work grow better and better.

[3] HUSNOT TH.—Muscologia Gallica: Descriptions et figures des mousses de France et des contrées voisines. 7e livraison. pp. 193–224. pl. liii–lx. roy. 8vo. Cahan: the author. 1888. 5 francs.

THE COMMISSIONERS of the state reservation at Niagara requested Mr. David F. Day, the well known botanist of Buffalo, to prepare a list of the flora of the vicinity of the falls. This list[4] comprises 909 species. Common names and remarks on the localities and relative abundance are given. From Mr. Day's reputation for painstaking accuracy, we are sure that the catalogue may be depended upon.

THE FIRST BULLETIN[5] of the division of pomology of the Department of Agriculture relates wholly to fruits which can only be cultivated in the Southern States or California. Two Japanese plums and three varieties of Japanese persimmons are figured in colors, and certainly look tempting enough. The remainder of the report gives accounts of the growing of various tropical and semi-tropical fruits which are either now cultivated or might prove profitable in the localities named. The number is surprisingly large.

NOTES AND NEWS.

DR. DOUGLAS H. CAMPBELL has been elected to the chair of botany in the State University of Indiana.

IN THE description of Polytrichum Ohioense, in the August GAZETTE, p. 200, Crowdin Mount, N. C., should read Crowder's Mount.

THE PROFESSORSHIP of botany at Bryn Mawr College has been consolidated with that of biology, under the charge of Dr. E. B. Wilson. We are sorry to record this backward step.

THE BOTANICAL CLUB, A. A. A. S., registered nearly sixty at Cleveland. So great has been the exodus to Europe this summer that that number may be looked upon as large. The absence of botanists from east of the Hudson was conspicuous.

MR. B. T. GALLOWAY, at present assistant in the section of vegetable pathology of the Department of Agriculture, will become the head of the section when Mr. Scribner assumes his duties at the University of Tennessee. The change will occur in October.

DR. DELAMARE, whose work in connection with the Flora of Miquelon was noticed in this journal for June (p. 168), died recently at Miquelon, as we learn from M. Jules Cardot. Dr. Delamare was an indefatigable collector, and had almost completed his botanical exploration of the island.

WERMINSKI gives[1] a brief account of his researches upon the nature of aleurone grains. He concludes that they are formed from vacuoles which contain proteids in solution. By loss of water in ripening the substance of the aleurone grain is precipitated through a physico-chemical process.

[4] DAY, DAVID F.—A catalogue of the flowering and fern-like plants growing without cultivation in the vicinity of the Falls of Niagara. pp. 67. 8vo. Troy: The Troy Press Co., printers. 1888.

[5] VAN DEMAN, H. E.—Report on the condition of tropical and semi-tropical fruits in the U. S. in 1887. pp. 149. pl. col. iii. 8vo. Washington: Gov't Printing-office. 1888.

[1] Ber. d. deut. bot. Gesellschaft vi. 199 (July 24, 1888).

PROFESSOR JOS. F. JAMES, lately of Miami University, will become professor of botany at the State Agricultural College of Maryland at the opening of the college year in September. The institution is located very near Washington, so that scientific companionship is not lacking for the teachers there.

THE EXTENT of Dr. Gray's fame is well illustrated by the fact that many of the smaller foreign periodicals, not especially botanical, have given longer or shorter notices of his life and works. Our attention is called to such a sketch, written by Dr. P. Magnus, in the *Naturwissenschaftliche Rundschau*, published at Braunschweig, Germany.

THE MEETING of the botanical section of the Philadelphia Academy of Natural Sciences held on February 13 was devoted to memorials of Dr. Gray by various members, each treating of a different phase of his work. Addresses were made by Mr. W. M. Canby, Prof. J. T. Rothrock, Dr. W. P. Wilson, and Mr. Thomas Meehan. A suitable series of resolutions offered by Mr. J. H. Redfield was then passed and ordered on record.

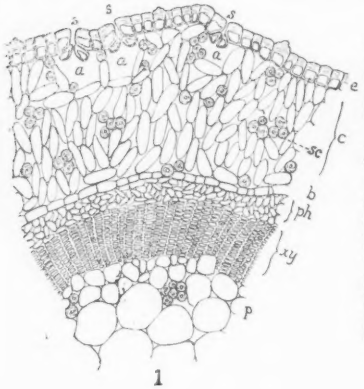
IN THE LAST FASCICLE of the *Annales des Science Naturelles* (*botanique*) (vol. vii, parts 2, 3, 4) MM. Bornet and Flahault continue their revision of the Nostocaceæ of French herbaria. The present part includes the eight genera of the Nostoceæ, of which two, a new one, Wollea,[2] and Hormothamnion, are not found in Europe. From the enormous synonymy of some species, we judge that the revision has come none too soon.

SECTION F, at the Cleveland meeting A. A. A. S., was rather unfortunate in its secretaryship. The secretary, Dr. N. L. Britton, was absent at Kew, England. Mr. B. E. Fernow, chief of the forestry division, Department of Agriculture, was elected secretary *pro tem.*; but on Monday morning he received word of the death of his wife's father, and was obliged to leave. The conclusion of the duties devolved upon Mr. C. R. Barnes, who was elected at the morning session.

DE VRIES has lately studied the young absorbing roots of plants with reference to the mechanics of the tissues. He concludes from the following experiments that either the so-called "bundle-sheath" (*Kernscheide*) or the pericambium, or both, bear the root pressure. A root of Iris Pseudacorus, 12 cm. long, with the root tip uninjured, was placed under a pressure of 35 cm. of mercury. Every fifteen minutes a microscopically thin tangential section was cut from the root at a place 2 cm. from the tip. No water appeared at the surface of the cut until the sheath was reached, when immediately a drop was exuded. Similar experiments with like results were made upon the roots of Dipsacus sylvestris and the stems of various plants. He also shows how the sheath is adapted to resist the filtration of the water under root-pressure before it becomes suberized. De Vries also states that the movement of protoplasm in the cells which take up or transport water is such as to facilitate its passage to the vascular system in the interior. In the root-hairs the rotation is from one end to the other; in the epidermis parenchyma sheath and pericambium the chief stream passes over the tangential and transverse walls. The movement is strongest in the cells in which the absorption of water is greatest. As the suberization of the walls proceeds it gradually decreases, and ceases when the process is complete.[3]

[2]Dedicated to our well known algologist, Rev. Francis Wolle, and including his Sphærozyga saccata.

[3]See abstract in Bot. Centralblatt, Band xxxv. 76 (1888).



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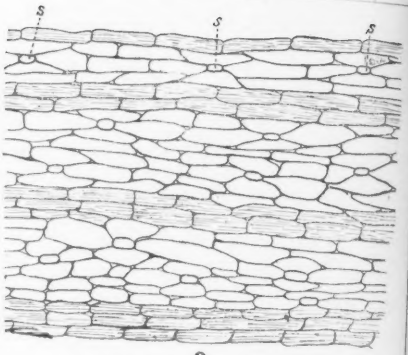

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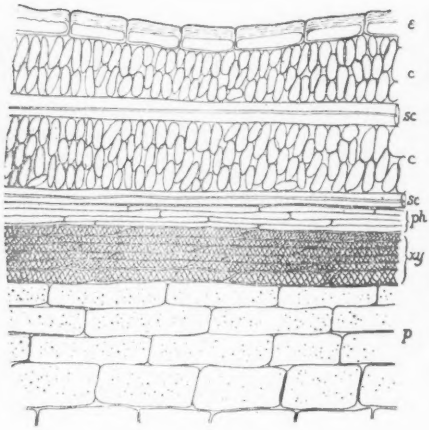

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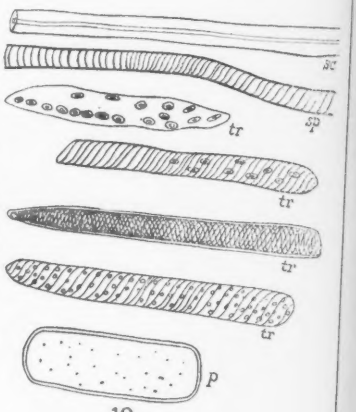

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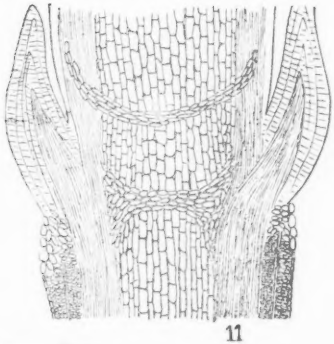

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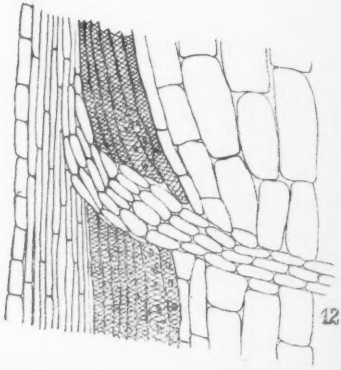

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EVANS on EPHEDRA.